Conclusions

PROJECT SUMMARY

OVERVIEW

Desmocerus californicus dimorphus is patchily distributed throughout much of the Central Valley from Redding to the Bakersfield area (Figures 8, 19). During the survey, evidence of the beetle was found at about 28 percent of the 230 sites with *Sambucus*, and in about 20 percent of the 504 groups of elderberry examined at those sites. Of those with exit holes, recent holes were present at about 52 percent of 64 sites, and in about 45 percent of 103 groups of elderberry. Where only old or healed holes were seen, early season sampling before adult emergence may have been a factor. Four adult beetles were collected at three sites in the eastern Central Valley. No evidence of the VELB was seen at several localities where it had been previously reported.

The valley elderberry longhorn beetle inhabits *Sambucus* of various sizes, ages, and growth forms, and utilizes an assortment of branch sizes for larval development. Two species, *S. mexicana* and *S. racemosa* var. *microbotrys*, serve as hosts. Elderberry shrubs/trees with VELB populations occur in a variety of habitats and plant communities, most commonly along the margin of riparian forest and in adjacent grassy savannas.

The beetle appears to be only locally common, i.e., found in population clusters which are not evenly distributed across available *Sambucus*. Frequently only particular clumps or trees in an area harbored the VELB, and other similar ones were unaffected. The infested plants usually showed evidence of utilization over a period of several years, but sometimes only one or two exit holes were present. Similar observations on the clustered distribution of exit holes were made by Jones and Stokes (1987a) and Halstead (1991d, pers. comm.). In the current study it was noted that elderberry shrubs/trees with many exit holes were most often large, mature plants; young stands were seldom infested.

The criteria for the selection of particular plants as hosts are not known. Perhaps the VELB continues to use the same host clumps/trees that were suitable habitat in the past in lieu of dispersal, i.e., they may be poor dispersers. In addition, some of the VELB populations inhabiting isolated groups of elderberry appeared to not have nearby

hosts to which to disperse. It is also possible that the beetle is very selective for *Sambucus* with special, as yet unknown, qualities.

SAMBUCUS WITH VALLEY ELDERBERRY LONGHORN BEETLE POPULATIONS

The valley elderberry longhorn beetle utilizes both *Sambucus mexicana* Presl. and *Sambucus racemosa* L. var. *microbotrys* (Rydb.) Kearney & Peebles (Appendix II). The limited data indicate that one species is not preferred over the other, and that the VELB uses whichever is available.

The VELB does not seem to favor any particular growth form of elderberry, but occurs in both arborescent plants, and bushy clumps and groves.

Most of the *Sambucus* observed were healthy, including those with VELB exit holes (Figure 35). A parallel was found between the health of the overall elderberry population, and those with previous or current VELB populations. This indicates that VELB presence is not a factor in producing unhealthy plants, and conversely, that unhealthy plants are not a factor in VELB presence. Clumps in poor health were more common later in the season as the weather became hotter and drier.

Exit holes were found in *Sambucus* with maximum diameters of 2.5-30 inches; about 64 percent (n=51) were in elderberry plants >3-9 inches in diameter (Figure 34). In general, the sizes of elderberry utilized roughly paralleled those in the overall population. An exception was those with maximum diameters of 3 inches or smaller which were inhabited only about half as much; no holes were found in those less than 2.5 inches in diameter. It appears that the either the VELB avoids elderberry plants which are very young or small, or that insufficient time had elapsed for a complete life cycle. Jones and Stokes (1987b), however, reported 10 percent of infested clumps in their study to be less than 2 inches in diameter.

Recent exit holes were always found in live wood; partly healed and healed holes were mainly in live wood; old holes were found more frequently in dead than live wood (Figure 51). Healthy, actively growing stems often heal, or close up, old emergence holes.

The density distribution of *Sambucus* groups (Figure 50) appears to have an affect on the presence or absence of the VELB: the beetle seems to prefer situations where groups are not isolated from each other. Sites with isolated or scattered plants were encountered almost equally, while three times as many sites with scattered elderberry had VELB populations. At sites where elderberry was abundant (i.e., many scattered and many), those with evidence of the VELB exceeded the overall percentage of these categories by about a third.

Sambucus serving as hosts for the VELB occurred in several plant communities: riparian forest, savanna or grassland, oak woodland, and mixed chaparral-foothill woodland. The VELB was more frequently encountered in riparian forest margin and elderberry savanna than other situations. Host plants grew in the open, without overstory, and also as understory plants.

VALLEY ELDERBERRY LONGHORN BEETLE

The three live adult beetles were captured in various orientations and positions on the elderberry plants: on foliage and on bark, inside the canopy (shaded, concealed) and outside (in sun, exposed), oriented horizontally and vertically, and oriented right-side-up and upside-down. One beetle was found dead in an exit tunnel. Flight was not observed.

The three beetles captured alive were maintained in the laboratory on a diet of fresh *Sambucus* leaves; the male lived for 17 days and the females for 25 days. A male and female placed together after capture mated off and on for at least five days. The females produced 80-110 eggs each, most of which were attached in crevices, depressions, and at petiole-stem junctions on the food plant.

Based on the presence of exit holes, the VELB seems to prefer stems for larval development and pupation which are larger than an inch or two in diameter. The largest number of recent exit holes, 50 percent (n=35), were in branches or trunks >2-4 inches in diameter (Figure 52). Only 10 percent occurred in branches 1.5 inches or smaller. Small stems may be under-represented because of insufficient time for larval development, pupation, and adult emergence. Branch/trunk diameters ranged from 0.6-10.0 inches for all holes, and 1.0-8.4 inches for recent holes.

The vertical heights of exit holes above the ground (Figure 55) ranged from 6-108 inches. About 70 percent (n=86) were 48 inches (4 feet) or lower, and 56 percent (n=68) were 36 inches (3 feet) or lower. These results may be biased by the greater ease at which lower elderberry trunks and branches are examined.

FACTORS AFFECTING THE VALLEY ELDERBERRY LONGHORN BEETLE

THE PRESENT OR THREATENED DESTRUCTION, MODIFICATION, OR CURTAILMENT OF ITS HABITAT OR RANGE:

Riparian fragmentation and destruction caused by agricultural conversion, waterway maintenance, and urbanization will continue to be a threat in the future. VELB populations inhabiting *Sambucus* that is isolated or widely scattered are especially vulnerable to being extirpated in some parts of the range. Despite legal protection of the beetle, host plants are still frequently injured through cutting and burning, and sometimes by herbicides.

Insecticide drift from cultivated fields and orchards adjacent to elderberry stands could have a deleterious effect on VELB populations if this occurs when adults are present. Evidence of insecticide residue on elderberry was noted by Jones and Stokes along the Sacramento River, and was cited as a possible factor in their failure to locate adults in 1986. At one of the localities in this study (#80-85), next to fields being sprayed, no evidence of the VELB could be found where an adult and exit holes had been seen six years ago (Arnold 1984, 1985).

OVER-UTILIZATION FOR COMMERCIAL, RECREATIONAL, SCIENTIFIC, OR EDUCATIONAL PURPOSES:

No evidence of over-utilization was noted during this survey, but since longhorn beetles (Cerambycidae) are very popular with collectors, it is possible that, if unprotected, the VELB could be adversely impacted due to its rarity and notoriety.

DISEASES OR PREDATION:

No direct evidence of either disease or predation was observed during this study. Disease or deformity may have caused the death of an adult VELB found undamaged and still in its exit hole. Jones and Stokes (1988) proposed that empty galleries without either larvae or emergence holes could have resulted from larval mortality.

It is possible that bird predation is a minor factor in regulating VELB populations, but it is also possible that aposematic coloration affords protection for the adults. A large number of bird nests were noted in elderberry shrubs/trees, probably due to their dense, brushy

nature. Although no predation was seen, many exit holes had been enlarged from the outside in a manner consistent with bird pecking. Jones and Stokes (1987b) discussed in depth the role of birds, probably woodpeckers, in enlarging exit holes and creating new holes in elderberry stems.

It has been reported that cattle readily forage on *Sambucus* (USFWS 1984, Halstead 1991a). Damage to the plants by large herbivores such as cattle or deer was not seen or recognized during the study, but such activity would be destructive to the eggs, larvae, and pupae of the VELB.

Arnold (USFWS 1984) suggested that the VELB itself weakens the elderberry host and makes it more susceptible to invasion by fungus diseases and other insects.

THE INADEQUACY OF EXISTING REGULATORY MECHANISMS:

This is not a currently problem since *Desmocerus californicus dimorphus* Fisher is listed on the Endangered Species Act of 1973, as amended. However, this is the only protection afforded the beetle since it and other insects are not safeguarded under the California Endangered Species Act, nor is it covered under any other special statutes.

RECOVERY

The Step-Down Outline and Implementation Schedule of the Recovery Plan (USFWS 1984) have only been minimally pursued. Until this year little has been accomplished besides Priority 1 tasks and surveys of the Sacramento River and part of the Cosumnes River.

This project was aimed at completing several of the remaining tasks dealing with the distribution and range, life history, and environmental requirements of the valley elderberry longhorn beetle. Some of these goals have been achieved, if only partially, but detailed life history and ecology information is still lacking. Specifically, Priority 2 tasks which remain incomplete are:

(1) Conduct field studies on autecology of VELB at known colonies, and at any newly discovered sites.
(2) Conduct laboratory studies to determine VELB life history.
(3) Determine synecology of riparian forest vegetation at these sites.

(4) Investigate autecology of *Sambucus* spp.
(5) Investigate the effects of grazing, disturbance and successional processes on *Sambucus* and VELB.
(6) Determine VELB population status and success of management actions.

The importance of these tasks should be considered when addressing whether or not *Desmocerus californicus dimorphus* should be removed from the Federal list of endangered and threatened wildlife.

RECOMMENDATIONS

I. Additional field study and collections of adult beetles are needed especially from the northern and southern ends of the range in the Redding and Bakersfield areas, the eastern edge of the Sacramento Valley, and the eastern foothills of the Coast Range. Although the VELB appears to be distributed throughout much of the Central Valley, it is known only from exit holes in a large portion of the range. Furthermore, except for those reported in this study and those of Halstead, most of the adult and exit hole records are older than five years. Some of those populations may no longer be extant.

II. Although prevailing scientific opinion presently supports the current status of the VELB, problems with male variability and the inability to identify some individuals except by collection locality has raised questions about the appropriateness of subspecific designations (Halstead 1990, 1991a). A major problem has been the lack of specimens throughout the range with which to study variation in the overall population. In order to determine the nature of the contact zone between the subspecies, observations and collections of adults are especially needed from the possible area of parapatry in the eastern foothills of the Coast Range. Important questions include:

(1) whether or not the subspecies are parapatric, i.e., have adjoining ranges
(2) if parapatric, whether a zone of intergradation or hybridization exists
(3) the presence or absence of clinal variation

III. Almost nothing is known about the dynamics of VELB population ecology. An in-depth, multiple-year study in a particular area is needed to answer questions about:

(1) the size and distribution of population groups
(2) the amount of habitat necessary to sustain a healthy population
(3) larval and adult mortality rates and causes
(4) continuous or synchronous emergence of adults
(5) dispersal/colonizing ability

IV. Study encompassing more than one life cycle is needed to address important, undocumented aspects of the life history of the VELB, such as:

(1) duration of life cycle
(2) the internal and/or external controlling factors influencing adult maturation and emergence
(3) daily activity period of adults
(4) adult feeding habits
(5) mate location
(6) presence/absence of pheromones

V. The ecological interactions between the VELB and its host plant should be more thoroughly investigated. It is not known how and why particular *Sambucus* individuals are selected as hosts, information which could be important in habitat preservation, restoration, and mitigation.

VI. A study should be undertaken to test the feasibility of inoculating elderberry shrubs with VELB eggs. Such a technique could prove to be a valuable tool in restoration of extirpated populations. In addition, controlled experiments would provide life history information that may be difficult or impossible to obtain in the field. The captive females in this project were easy to maintain and produced many viable eggs.

VII. There is a definite need for education aimed at landowners and personnel of agencies in charge of public lands in order to minimize damage to the VELB's host, *Sambucus*.

VIII. The VELB should not be removed from the Federal list of endangered and threatened wildlife unless permanent protection is insured for disjunct populations in different parts of the Central Valley. In that event, a system of federally designated VELB refuges, where the beetle and its host plant could be protected, studied, and closely monitored, is strongly recommended. Some excellent habitat (i.e., mostly undisturbed, with numerous healthy *Sambucus*) with valley elderberry

longhorn beetle populations is present on lands that are already set aside for public use as parks, recreation areas, and wildlife refuges. These are noted in Table 1. These lands, or portions thereof, are not presently managed specifically for the VELB.